

REMARKS:

Claims 1-11, 14-22, 24-26, 29-34

Claims 1-11, 14-22, 24-26 and 29-34 have been rejected under 35 USC 102(b) as being anticipated by Parkin (US6153320).

Claim 1 has been amended to further require an in-stack bias layer for stabilizing the free layer, wherein the free layer is positioned between the bias layer and the AP pinned layer structure, wherein the bias layer is not adjacent an antiferromagnetic (AFM) layer. This feature is not found in Parkin.

Nor would claim 1, as amended, be obvious over Parkin in view of Pinarbasi (US2003/0179513) and in further view of Saito et al. (US2003/0011948). The rejection of claim 12, which contains a similar limitation, relies on Pinarbasi to show an in-stack biasing structure. However, as shown in Pinarbasi Figs. 10-11, the pinned layer is always adjacent an AFM layer. In sharp contrast, claim 1 now requires that the in-stack bias layer is not adjacent an antiferromagnetic layer. Accordingly, the amendment to claim 1 is believed to render claim 1 allowable over the prior art.

Claims 2-8 and 33 are dependent upon claim 1, and therefore incorporate the requirements of claim 1. Thus, they are also believed to be allowable over the cited references.

Claim 9 has been amended to require an in-stack bias layer, the bias layer stabilizing the free layer, the AP pinned layer structure stabilizing the in-stack bias layer. This limitation was taken from claim 12, and is not found in Parkin.

Nor would claim 9, as amended, be obvious over Parkin in view of Pinarbasi and in further view of Saito. The analysis of obviousness was set forth in *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966). In order to establish a *prima facie* case of obviousness, three basic criteria must be met:

First, there must be some *suggestion or motivation*, either in the

references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the teachings of the references. Second, there must be a *reasonable expectation of success*. Finally, the prior art reference or combined references must teach or suggest *all the claim limitations*. *The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art*, and not based on applicant's disclosure (*In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991; emphasis added).

Independent claim 9 has been amended in a manner that would cause any rejection based on the proposed combination of art to fail the *Graham* test. Specifically, any such rejection would fail the third element of the *Graham* test.

Regarding independent claim 9, the rejection fails at least the third element of the *Graham* test. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Claim 9 requires an in-stack bias layer, the bias layer stabilizing the free layer, the AP pinned layer structure stabilizing the in-stack bias layer. The rejection points to Pinarbasi's biasing layer structure described in [0046] of Pinarbasi as meeting the claimed in-stack bias layer, the bias layer stabilizing the free layer, the AP pinned layer structure stabilizing the in-stack bias layer. However, looking to Pinarbasi's specification and drawings, it is seen that Pinarbasi's pinned layer 244 is stabilized by the AFM pinning layer 248. The rejection fails to indicate whether or where Pinarbasi discloses that the AP pinned layer structure stabilizes an in-stack bias layer, as claimed. Rather, Pinarbasi discloses a 150 Å thick PtMn AFM layer adjacent the pinned layer 244 to stabilize the pinned layer 244. No teaching or suggestion is made that the AP pinned layer structure 204/304 stabilizes the pinned layer 244. Thus, the claimed element of wherein the AP pinned layer structure stabilizes an in-stack bias layer is not taught or suggested in the art of record, as required by the third element of the *Graham* test. Because not all claim limitations are taught or suggested, the rejection of claim 9 is improper as failing the third element of the

Graham test. Reconsideration and allowance of claim 9 is respectfully requested.

Claims 10-11 and 14-17 depend from claim 9, and therefore incorporate the limitations of claim 9. By virtue of their dependence, claims 10-11 and 14-17 are also believed to be allowable. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Reconsideration and allowance of claims 10-11 and 14-17 is respectfully requested.

Claim 18 has been amended in a manner similar to claim 9, and is therefore also believed to be allowable over the art of record for similar reasons. Reconsideration and allowance of claim 18 is respectfully requested.

Claims 19-26, 29-32 and 34 depend from claim 18, and therefore incorporate the requirements of claim 18. Thus, they are also believed to be allowable over the cited references.

Additionally, claims 1-34 require that the antiparallel pinned layers have about identical thicknesses. Support for this amendment is found in FIGS. 7-12, for example. In sharp contrast, Pinarbasi's AP pinned layers have AP pinned layers of very different thicknesses. See, for example, Pinarbasi FIGS. 10 and 11. Likewise, Saito teaches and suggests that the AP pinned layers have different thicknesses that are not about identical. Consider the following quote from Saito, which was also cited in the rejection:

[0017] The direction of magnetization of the first pinned magnetic layer 112 is anti-parallel to the direction of magnetization of the second pinned magnetic layer 114, and the magnetic moment of the first pinned magnetic layer 112 cancels the magnetic moment of the second pinned magnetic layer 114. However, since the thickness t_{P1} of the first pinned magnetic layer 112 is slightly larger than the thickness t_{P2} of the second pinned magnetic layer 114, a few magnitude of spontaneous magnetization remains due to the

contribution of the first pinned magnetic layer **112** to leave the pinned magnetic layer **104** to be in a ferrimagnetic state. This spontaneous magnetization is further amplified by the exchange coupling magnetic field with the antiferromagnetic layer **103** to fix the direction of magnetization of the pinned magnetic layer **104** toward the Y-direction. (*emphasis added*)

See also, Saito paragraph [0192]. Accordingly, it can be appreciated that Saito only suggests pinned layers having different thicknesses. It follows that Saito cannot suggest modification of Pinarbasi to have pinned layers of substantially identical thickness. Because not all claim limitations 1-34, particularly as amended, would be improper as failing the third element of the *Graham* test. Reconsideration and allowance of claims 1-34 is respectfully requested.

Regarding the first prong of the *Graham* test in relation to claims 1-34, both Pinarbasi and Saito teach away from AP pinned layers having nearly identical thickness. A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997) (*emphasis added*). It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). As noted above, Pinarbasi discloses pinned layers of differing thicknesses. Likewise, Saito states several times that the first and second pinned layers have different thicknesses. *See inter alia*, Saito [0017, 0192]. Accordingly, the references themselves teach that the thicknesses of AP pinned layers should be different. Thus, it cannot be said that either reference suggests the combination of features proposed in the rejection. For this reason as well, any rejection based on Pinarbasi and Saito would fail the *Graham* test. Reconsideration and allowance of claims 1-34 is respectfully requested.

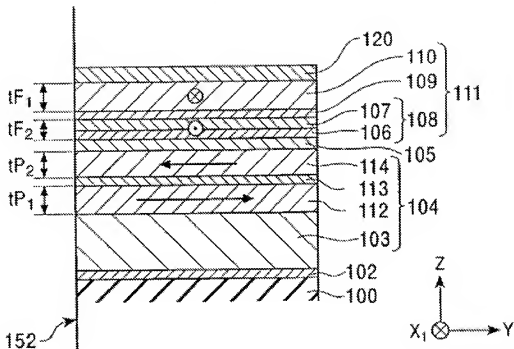
Additionally regarding the third element of the *Graham* test in relation to claims 9-34, claims 9-34 have also been amended to require that the net magnetic moment of the AP pinned layer structure is substantially equal to zero. As conceded in Section 2 of

the Office Action, Pinarbasi does not state that the net magnetic moment of the pinned layer structure equals about zero, much less substantially equal to zero. Saito has been added to provide this feature. However, upon closer examination of Saito, it appears that Saito actually teaches AP pinned layer structures that have a net magnetic moment that is purposely made to have some meaningful magnitude greater than zero. The rejection points to paragraph 0017 of Saito, reproduced immediately below.

[0017] The direction of magnetization of the first pinned magnetic layer 112 is anti-parallel to the direction of magnetization of the second pinned magnetic layer 114, and the magnetic moment of the first pinned magnetic layer 112 cancels the magnetic moment of the second pinned magnetic layer 114. However, since the thickness t_{P1} of the first pinned magnetic layer 112 is slightly larger than the thickness t_{P2} of the second pinned magnetic layer 114, a few magnitude of spontaneous magnetization remains due to the contribution of the first pinned magnetic layer 112 to leave the pinned magnetic layer 104 to be in a ferrimagnetic state. This spontaneous magnetization is further amplified by the exchange coupling magnetic field with the antiferromagnetic layer 103 to fix the direction of magnetization of the pinned magnetic layer 104 toward the Y-direction. (*emphasis added*)

As noted, the thicknesses of the pinned magnetic layers are made different, giving an overall net magnetic moment that does not equal zero, as net magnetic moment is a function of thickness of the magnetic material. Particularly, the thickness of the first pinned layer 112 is greater than the thickness of the second pinned layer 114 so that not only does the magnetic moment of the first pinned magnetic layer cancel out the magnetic moment of the second pinned layer, but also provides “a few magnitude of spontaneous magnetization,” in other words, a net magnetic moment of some magnitude greater than zero. This assertion is proven when viewing Saito’s FIG. 30 (reproduced below), which shows the arrows representing the magnetizations of pinned layers 112 and 114 as being of different magnitudes, thereby indicating that the pinned layer structure 112/113/114 has a net magnetic moment much greater than about zero.

FIG. 30
PRIOR ART



The other embodiments disclosed in Saito likewise have AP pinned layer structures having net magnetic moments purposely made to be greater than about zero. Note, *inter alia*, Saito's FIGS. 2, 8, 10 and 12.

Additionally, Saito indicates that the pinned layer structure is in a ferrimagnetic state in paragraph 0017. A "ferrimagnetic state" is referred to in Saito paragraph 0030 in relation to the free layer as satisfying the relationship $M_1t_1 > M_2t_2$. This relationship requires a net magnetic moment that does not equal about zero. A definition of ferrimagnetic is: noting or pertaining to a substance, as a ferrite, in which the magnetic moments of some neighboring atoms point in opposite directions, with a net magnetization still resulting because of differences in magnitudes of the opposite moments. [Source: *Random House Unabridged Dictionary*, Copyright © 1997, by Random House, Inc., on Infoplease (www.infoplease.com), *emphasis added*.] From this

definition, it is seen that a net magnetization exists in Saito's ferrimagnetic AP pinned layer structure.

For any of the foregoing reasons, reconsideration and allowance of claims 1-34 is respectfully requested.

Claims 12, 13, 27, 28

Claims 12, 13, 27 and 28 have been rejected under 35 USC 103(a) as being unpatentable over Parkin in view of Pinarbasi (US2003/0179513) in view of Saito et al (US2003/0011948).

Claims 12 and 13 depend from claim 9, and therefore incorporate the requirements of claim 9, distinguished from the cited references above. Thus, claims 12 and 13 are also believed to be allowable over the cited references.

Claims 27 and 28 depend from claim 18, and therefore incorporate the requirements of claim 18, distinguished from the cited references above. Thus, claims 27 and 28 are also believed to be allowable over the cited references.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 971-2573. For payment of any additional fees due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account No. 50-2587 (Order No. HSI920030118US1).

Respectfully submitted,

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